Introduction

Welcome to **Awesome Space Robotics**, a curated list of *awesome* resources for **Space Robotics**!

Motivation

The goal of this project is to provide a community-driven collection of valuable resources for students, researchers, professionals, and enthusiasts interested in space robotics. Instead of creating an exhaustive list of all available resources, our focus is on maintaining a curated list of high-quality references that remain relevant to the field. Furthermore, we strive to organize all interdisciplinary topics into a structured and easily navigable format, featuring diverse resources in the form of academic papers, books, tutorials, software tools, datasets, and more.

Contributing

The breadth of interdisciplinary topics within space robotics makes it challenging for any individual to cover all aspects of the field. We are grateful to all contributors who share their expertise in helping to build this list. Contributions are encouraged and welcome from everyone, regardless of background or experience level. Here are several ways in which you can contribute:

- **Report a Mistake**: Identify and report any mistakes in the list
- **Suggest a New Entry**: Propose a new entry to be added to the list
- **Suggest Entry Removal**: Recommend the removal of an existing entry from the list
- **Suggest a New Category**: Suggest a new category to improve list organization
- **Suggest Category Merge**: Propose merging two or more categories with overlapping content

Alternatively, you can contribute directly by **submitting a Pull Request (PR)**.

We appreciate your support!

Systems

Hardware Platforms

Open Source

- ExoMy - Open source build-it-yourself rover developed by ESA. It is inspired by the ExoMars rover and designed to be a low-cost platform for educational purposes. ExoMy features Ackermann steering and can be controlled via ROS using an onboard Raspberry Pi.
- JPL Open Source Rover - Open source build-it-yourself rover developed by JPL. It is based on the deployed Mars rovers and designed to be an affordable platform for education and research. The rover can be controlled via ROS using an onboard Raspberry Pi.

Research

- Astrobee - Free-flying robotic system developed by NASA to assist astronauts inside the ISS. Three Astrobees were launched to the ISS in 2019, each equipped with cameras, sensors, and a perching arm. The software stack is open source and built using ROS and Gazebo.
- Robonaut2 (R2) - Humanoid robot developed by NASA to assist astronauts onboard the ISS. R2 was launched in 2011 as the first humanoid robot in space and has since been used in various experiments on simple manipulation tasks.

Commercial

Software Frameworks

- F´ (F-Prime) - Component-driven framework for spaceflight applications and embedded systems with limited resources. It has been successfully deployed on several space missions.
- Robot Operating System (ROS) - Middleware framework for robotics with a set of libraries and tools for building robot applications. It has a wide adoption in the robotics community.

  - Space ROS - Fork of ROS 2 that aims to align with the safety and reliability requirements of space missions.

Simulation Environments

Verification & Validation

Laboratory Facilities

Orbital

- Zero-G Lab - Facility at the University of Luxembourg designed for testing 2D and 3D free-floating robotic systems in microgravity conditions. Its dark room features a 5x3 m flat epoxy floor on which pneumatic platforms use pressurized air to emulate free-floating behaviour in a 2D plane, while wall- and ceiling-mounted articulated robotic arms on linear rails extend the workspace into 3D. The lab is equipped with adjustable illumination and a motion capture system.

Planetary

- LunaLab - Moon analogue facility at the University of Luxembourg. It features an indoor 11x7 m area filled with 20 t of basalt gravel to emulate the surface of the Moon. LunaLab is equipped with adjustable illumination and a motion capture system to support the development and testing of lunar rovers.

Terrestrial Analogue Sites

- Mount Etna (Italy) - Active volcano with fresh volcanic soils and lava flows, serving as an excellent analogue for the Moon and Mars. ESA and DLR have tested several rovers and robotic operations at this site.

Algorithms

Perception

Navigation

Manipulation

- [MoveIt](#) - Open source general-purpose motion planning framework built on top of ROS. MoveIt combines kinematic solvers, collision checking, path planning, trajectory optimization, perception and control in a unified framework for robotic manipulation.

Human-Robot Interaction

Robot Learning

Applications

Exploration

Assembly & Servicing

Resources

Education

Demos

Web

- [JPL Open Source Rover (Homepage)](#) - Simulated Mars rover that can be controlled through a simple teleoperation interface.

Datasets

Assets

- [NASA-3D-Resources](#) - Collection of copyright-free 3D models, textures, and images NASA.

Benchmarks

Competitions

Community

Organizations

Recurring Events

- [International Conference on Space Robotics (iSpaRo)](#) - Annual peer-reviewed conference aiming to provide a framework for academia and industry to engage in discussions and share their insights on emerging topics in space robotics. The first edition of iSpaRo was held in 2024.

Contributors

Awesome Space Robotics is a community-driven effort that would not be possible without the help of the following contributors:

- Andrej Orsula